

Honors in Biology (3-6 credits/semester)

Course Catalog Code and Section Number

119:408, 409

Semester

Fall (119:408), Spring (119:409)

Course Coordinator and Contact Information

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Course Meetings

No scheduled meetings as a class, students must coordinate their Honors in Biology Faculty Mentor create a schedule for the semester to fulfill the required hours.

Requirements

Students must be declared biological sciences major entering final year at Rutgers with previous life science research experience. Candidates must have a minimum cumulative GPA of 3.0 and Bio GPA of 3.4 and must complete a minimum of 3 credits of Honors in Biology in fall and 3 credits in spring semester of final year.

Course Description

Honors in Biology provides highly motivated students with an opportunity to immerse themselves in a scientific research project. Students engage in laboratory or field experimentation under the direct supervision of a faculty mentor. Each student completes his or her own original research project. Direct laboratory exposure is an essential component of this course. Honors in Biology projects are more sophisticated than Research in Biology projects. Students must complete a minimum of six credits to qualify for Departmental Honors. Each credit requires 4-5 hours per week per credit of research. Students must submit a written thesis accompanied by an oral presentation and thesis defense in the spring semester. The thesis committee must be composed of at least three faculty members, including the research advisor and at least one member of the Division of Life Sciences faculty.

Learning Goals

By the end of the course, students should be able to:

1. Demonstrate both factual and conceptual knowledge of the field.
2. Demonstrate the ability to analyze, present, and interpret scientific data.
3. Demonstrate clear understanding and justification of their research hypothesis and the experimental methods/design and limitations.

4. Demonstrate ability to draw accurate and appropriate conclusions and identify implications and future directions of the research.

Grading and Assessment

- Scale: A (90-100), B+ (85-89), B (80-84), C+ (75-79), C (70-74), D (65-69), F (<65)

How to Enroll in the Course

Application Deadline: Third Friday of the Semester

INSTRUCTIONS TO APPLY IN FALL:

1. **Discuss Conducting Honors in Biology with your current Faculty Research Mentor.** Discuss a new project or the continuation of your current project to complete over the fall and spring semester. Ensure that you fully understand what the expectations are before committing by confirming responsibilities, time commitment, and necessary prerequisites. Students must complete a minimum of 4-5 hours in the laboratory per week per registered credit of Honors in Biology. Students must complete a minimum of 3 credits during both the fall and spring semesters.
2. **Prepare a 3-page research proposal, written by you, describing your research project for the full year.** The proposal must have a description of the background information necessary to understand and justify the work, a specific hypothesis to be tested, a detailed description of the data that you will collect, and a prediction about the results you will obtain. The proposal should also justify the number of credits for which you would like to register for. If you are unsure whether your research project is appropriate, meets departmental guidelines, or if this is your first time applying under our research courses, please feel free to contact Dr. Carr-Schmid (schmid@biology.rutgers.edu).
3. **Initiate Fall Honors in Biology Contract Powerform.** You will need your Faculty Research Mentor's contact information for completion of the contract. Complete all indicated areas for Student Researcher. The power form contract goes next to the Faculty Research Mentor for approval and then to Dr. Carr-Schmid for final departmental approval. Please note that post-docs and graduate students MAY NOT serve as Faculty Research Mentors.
4. **Once your application receives approval, you will receive an email from DocuSign indicating the contract is complete, and you will be able to view the finalized contract.** Your course index number and spn to register will be provided on the last page of the contract. If you complete this process before drop/add ends, you may register yourself. After the drop/add period, you must contact your SAS or SEBS Academic Advising Office (you can use their live chat) for assistance with registering for the course. Other courses dropped after drop/add will result in a W, so if you need the course to drop another, you must complete the application and receive approval and the spn before drop/add ends. Once registered for the course, please visit the CANVAS course site, and review any additional course information and deadlines.

INSTRUCTIONS TO APPLY IN SPRING:

1. **Initiate the Spring Honors in Biology Contract Powerform.** You do not need to submit another research proposal, unless your project has changed significantly from what was approved in the fall. You will need your Faculty Research Mentor's contact information for completion of the contract. Complete all indicated areas for Student Researcher. The DocuSign contract goes next to the Faculty Research Mentor for approval and then to Dr. Carr-Schmid for final departmental approval. Please note that post-docs and graduate students MAY NOT serve as Faculty Research Mentors. You can also indicate in the contract if you want to be enrolled in the Honors Science Communication 119:410 support course.
2. **Once your application receives approval, you will receive an email from DocuSign indicating the contract is complete, and you will be able to view the finalized contract.** Your course index number and spn to register will be provided on the last page of the contract. If you complete this process before drop/add ends, you may register yourself. After the drop/add period, you must contact your SAS or SEBS Academic Advising Office (you can use their live chat) for assistance with registering for the course. Other courses dropped after drop/add will result in a W, so if you need the course to drop another, you must complete the application and receive approval and the spn before drop/add ends. Once registered for the course, please visit the CANVAS course site, and review any additional course information and deadlines.

Key Requirements

For Fall Semester:

- An Honors in Biology contract and 3-page proposal must be submitted and approved to register for the fall semester.
- Students must submit a minimum of 10 pages written, graded paper (guidelines provided on canvas course site).
- Students must complete a 1–3-minute video about their research project, designed for general audiences, which is due at the fall semester mid-point (guidelines on the Canvas course site).
- A rough draft of the final paper must be prepared one week in advance of the due date and submitted to both the research mentor and through the Canvas course site.
- The final version of the paper, graded by the Faculty Research Mentor, is due by the second (or only) reading day at the end of the semester and must be submitted to the Canvas course site.
- The Student Initiates the DocuSign Honors in Biology Grading Form and the Faculty Research Mentor completed the assessment.

For Spring Semester:

- A new Honors in Biology contract is required for registration for spring, but a new proposal is not necessary unless the project has significantly changed from the original fall proposal.
- Students must assemble a thesis committee including their mentor and 2 faculty members (any 1 of which must be a faculty member of the DLS undergraduate program (Bio, Genetics, CBN, MBB)).
- Students prepare and submit a 30-50-page written thesis (according to guidelines provided on the Canvas course site) by early April. And submit to their thesis committee and revise the

written thesis based on any committee feedback. Specific deadlines and requirements will be provided to students on the Canvas course site.

- Students may enroll in our 1 credit Honors Communication in Science course (01:119:410) for assistance with thesis paper and presentation preparation. This course does not count toward the Bio major requirements.
- Students will complete a thesis presentation with the thesis committee and any invited audience. We anticipate all thesis defenses will be held in-person, unless a virtual defense is requested by your Research Faculty Mentor. It may be held in person with one or more thesis committee members attending virtually.
- The three-member thesis committee will complete the thesis evaluation of both the oral presentation and written thesis presentation. A link to the DocuSign Power form Thesis Evaluation Form will be shared closer to thesis defense phase (a rubric is shared on the Canvas site for your convenience).
- The Faculty Research Mentor will evaluate the student's laboratory efforts each semester and determine the final grades for the Honors in Biology courses.

Additional Course Requirements

- The student's honors research project requires approval by the Director of Advising for Biological Sciences and revisions of the proposal may be necessary.
- The deadline to apply is the third Friday of the semester you want to enroll in. Students should submit paperwork by drop\add deadline if registration in the course is required to avoid a W for dropping a placeholder course.
- Students receive training and supervision and must be active participants in their research project.
 - Group projects are not acceptable.
- Research projects may not involve the use of human subjects. • Any necessary research safety training and animal use training (if applicable) in compliance with school policies are the responsibility of the Faculty Research Mentor.
- Students must complete at least 4-5 hours per week per registered credit.
- Student researchers may not receive financial compensation or receive credit through another department/program for any hours applied toward Research in Biology credit hours.
- Students participating in Aresty Research program for credit may submit their proposal for evaluation and if accepted, complete the research contract and switch registration over to Honors in Biology. If they complete the requirements for the Honors in Biology, it can count toward the Biological Sciences major.
- Completion of Honors in Biology may fulfill the capstone requirement for the Honors College or SAS Honors program.
- SEBS students completing GH COOK should register for GH COOK course and complete and submit the GH COOK SCHOLARS' APPLICATION FOR HONORS IN BIOLOGY CONTRACT (see Research for Credit site) and include their proposal for their project for approval.
- Students must complete all Honors in Biology requirements to earn departmental honors.

Thesis Guidance

Purpose of honors thesis: to show that you have mastered the scientific process!

You understand the purpose/significance of your study, you can formulate a workable hypothesis, you can analyze your data qualitatively and quantitatively, you can troubleshoot your experiments, you can draw logical conclusions based on your data and you can communicate your findings effectively.

Overall writing format: DOUBLE-SPACED with font size no less than 12 in doc, docx or pdf.

Thesis format:

Total: double-spaced 30-40 pages

Title page: 1 page

Abstract: 1-2 pages (summarize the results/observations/troubleshooting of your project)

Acknowledgement: page 1 (acknowledge the lab personnel or collaborator for any result in your thesis that is not completed by you)

Table of content: optional

Introduction: 5-10 pages (literature relevant to your research project)

Materials and methods: 4-8 pages (Describe the procedures in your own words, do not copy the literature)

Results: 10-25 pages; organize data/observations/troubleshooting strategies/expected results in figures and tables. All figures and tables should have detailed figure legends and labeling.

Discussions: 2-6 pages (compare research data with literature, discuss expected results, or propose future directions/experiments/troubleshooting strategies)

References: 1-3 pages (alphabetized your reference)

Components of the Thesis:

- (A) Title:** I should describe the purpose and/or the conclusion of your project. Use the appropriate title page for your thesis.
- (B) Abstract:** A good abstract will have the following points in the following order:
1. Purpose of your study and/or the significance of the molecule you are studying (or state your hypothesis).
 2. Summarize the results of each major experiment. Do not include experimental details unless they are novel findings.
 3. Conclusion of your project. What do your results contribute to the scientific field or possible future implications (studies) that can be derived from your results?
- (C) Acknowledgements:**
Thank you to everyone who has contributed to your project or aided in your success in the laboratory. If some of the experiments in your thesis were conducted by other lab members, acknowledge their contributions here.
- (D) Table of Contents:**
Optional – appropriate if using chapters for different projects completed.
- (E) Introduction** (should be divided into subsections with meaningful subtitles):
-A generic format is as follows (notice that this is an upside-down triangle format, going from broad to specific):



- The physiological significance of your study and the molecular mechanisms underlying the physiological phenomenon that you are interested in studying.
- The current knowledge on the molecule (or a part of the process) that you are studying.
- What additional knowledge is needed (or what additional questions can be asked) for this molecule (or part of the process).
- What experiments (or experimental approaches) you are proposing to answer the above question (list the major experiments in your lab report). State your hypothesis.

(F) Materials and Methods:

- List the procedures conducted in your project.
- Include pictures or diagrams to explain your procedures whenever you can (a picture is worth a thousand words).
- If you have pictures or diagrams, you **MUST** have figure legends describing them.
- Use a flowchart, table, or diagram to summarize your experimental approaches in your project if possible.

(G) Results:

1. Organize your results into subsections with meaningful titles that help the readers to predict what this subsection is about.
2. Use tables to summarize your qualitative and quantitative results. Whenever you can, be quantitative in your data analysis (i.e., error bars, statistical significance, number of times you have repeated the experiments).
3. Discuss ALL presented figures. Each figure **MUST** have a clear figure legend that describes what the figure is about. When you discuss the figure, use arrows to show specific details that you have discussed in your results. Explain what the arrows mean in the legend.
4. For pictures of DNA and protein gels, show labeled molecular weight standards at the same size as your gel. Label each lane with appropriate names instead of numbers or letters whenever possible. Label bands of interest on your gel that you are discussing in the text.
5. For cell staining/labeling micrographs, show scale bars and label each image panel with names rather than numbers or letters whenever possible. Make sure that the features you want the readers to see are clearly visible in your picture.
6. For graphs, show error bars, number of trials (n) and statistical significance analysis.
7. What to write in results:

Explain ALL figures. For each figure, include the following discussion:

- Summary of concepts/purpose behind each experiment discussed in the figure
- State the obtained results, compare them with the predicted results (your hypothesis) and/or literature. Try to be quantitative in your description of results whenever possible (i.e., percentage of cell population, number of mice).
- If there is total agreement, confirm that you have achieved the specific purpose for that experiment.
- If there is any discrepancy, discuss the differences and the reasons for the differences. Discuss that, even with these discrepancies, did you achieve the specific purpose for that experiment?
- If an experiment did not work, discuss potential reasons, and plans of troubleshooting.
- If your results are novel, discuss why and how they are different from what is known in the research area so far.

(H) Discussion:

-A generic format for discussion is as follows:

-State the purpose of your study (why you are conducting your studies and what is your hypothesis).

-State whether your overall experiments have achieved the purpose. Summarize the contribution of each major experiment to your overall goal.

-Include an explanation of why do think you have or have not achieved your purpose.

-How do you think your findings contribute to the current understanding of the studied process or molecules?

-State experiments or experimental approaches that you think would improve the current experimental design and/or further our current understanding of the molecule or of the process you are studying.

(I) References:

-Organize your references in alphabetical order.

Late Work

Failure to complete thesis presentation by 4/10/26 will result in students being ineligible for departmental awards and may prevent acknowledgement at graduation and ceremony handbook.

Advice for Success:

Often students (and sometimes research mentors) want to delay the thesis defense for additional experiments they deem critical. Students who do not complete their thesis defense by the deadline may not be listed in their graduation commencement booklets as receiving honors and will not be eligible for additional departmental or school awards. Students continue their work in the lab through the end of the semester. Therefore, it is not necessary that every experiment be completed for defense. Often one or two students will rush at the end to complete "just one more experiment." This rush usually results in experiments that most often do not pan out and then the student is not well prepared for their defense. You can continue conducting experiments but be sure to set aside the necessary time to prepare your thesis and defense. There will always be one more experiment to do. Your laboratory research, your written thesis, and your oral presentation are all factored together in your final grade and in your level of honors.

**Any questions or concerns, please first speak with your Faculty Research Mentor.
If it is not resolved, speak with Dr. Carr-Schmid!**

Course and University Policies

Academic Integrity

Rutgers University takes academic dishonesty very seriously. By enrolling in this course, you assume responsibility for familiarizing yourself with the Academic Integrity Policy and the possible penalties (including suspension and expulsion) for violating the policy. According to policy, all suspected violations will be reported to the Office of Student Conduct. Academic dishonesty includes (but is not limited to):

- Cheating

- Plagiarism
- Aiding others in committing a violation or allowing others to use your work.
- Failure to cite sources correctly.
- Fabrication
- Using another person's ideas or words without attribution, including re-using a previous assignment
- Unauthorized collaboration
- Sabotaging another student's work

Consult *Don't Plagiarize: Document Your Research!* This document offers tips about how to take notes so that you don't plagiarize by accident: http://www.libraries.rutgers.edu/avoid_plagiarism. If you are ever in doubt, please consult one of your instructors for guidance.

AI Usage Statement for this Course

In this course, students may not use Generative AI tools like ChatGPT and Gemini in preparation of their research paper. Submitting AI-generated work as your own is not permitted and is an academic integrity violation.

Technology Requirements

Students must have computer access to the Canvas course site. Please visit the Rutgers Student Tech Guide page for resources available to all students. If you do not have the appropriate technology for financial reasons, please email Dean of Students deanofstudents@echo.rutgers.edu for assistance. If you are facing other financial hardships, please visit the Office of Financial Aid at <https://financialaid.rutgers.edu/>.

Disability Accommodations

To register for accommodations and consult the policies and procedures of the Office of Disability Services website: <https://ods.rutgers.edu>. To receive consideration for reasonable accommodation, a student with a disability must participate in an intake interview and provide documentation to the Office of Disability Services.

Student Support and Mental Wellness

- Student Success Essentials: <https://success.rutgers.edu/>
- Student Support Services: <https://www.rutgers.edu/academics/student-support/>
- The Learning Centers: <https://rlc.rutgers.edu/>
- Rutgers Libraries: <https://www.libraries.rutgers.edu/>
- Bias Incident Reporting: <https://studentaffairs.rutgers.edu/bias-incident-reporting/>
- Dean of Students – Student Support Office: <https://success.rutgers.edu/resource/dean-students-student-support-office>
- Office of Veteran and Military Programs and Services: <https://veterans.rutgers.edu/>
- Student Health Services: <http://health.rutgers.edu/>
- Counseling, Alcohol and Other Drug Assistance Program & Psychiatric Services (CAPS): <http://health.rutgers.edu/medical-counseling-services/counseling/>



- UWill: free immediate access to teletherapy; you can choose a therapist based on your preferences including issue, gender, language, ethnicity. <http://health.rutgers.edu/uwill/>
- Office for Violence Prevention and Victim Assistance: www.vpva.rutgers.edu/
- Office of Disability Services: <https://ods.rutgers.edu/>
- Basic Needs Assistance (food, housing, and other essentials): <https://ruoffcampus.rutgers.edu/basic-needs>
- Rutgers Student Food Pantry: <https://ruoffcampus.rutgers.edu/food-pantry>